Before the
Federal Communications Commission
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
1998 Biennial Regulatory Review	)	**CC Docket No. 98-94**
Testing New Technology	)	
	)	

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MCI COMMENTS

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July 21, 1998

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I. Introduction

In the Notice of Inquiry (*Notice*) in the above-captioned proceeding, the Commission solicited comments about the effects of its Title II regulations on technical and market trials involving advanced telecommunications services and technology.[1] The Commission specifically raised the following issues for discussion:

- Should the Commission use Section 11 of the Communications Act to promote technology testing? And if so, how may it apply its Section 11 mandate to promote technology testing?

- Should the Commission apply its Section 10 forbearance authority in order to promote technology testing, such as encouraging forbearance applications or defining a class of experimental services that would qualify for forbearance treatment?

MCI contends that the Commission has already exercised its Section 10 and 11 authority sufficient to promote incumbent local exchange company (ILEC) technology and market testing. The Commission has established significant regulatory relaxation that has permitted numerous ILEC market and technology tests.

The one area that is crying out for relaxed regulation is technology and market testing by competitive local exchange companies (CLECs) and interexchange companies (IXCs). The Commission encouraged commentors to offer any and all relevant and helpful suggestions to promote technology testing.[2] Moreover, Congress required the Commission to give special consideration to the impact on competition that forbearing from its regulations might engender.[3] MCI's comments will show that forbearing from certain tariff requirements will facilitate

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[1]In the Matter of Biennial Regulatory Review — Testing New Technology, CC Docket No. 98-94, released June 11, 1998.

[2]*Notice* at 3.

[3]See §10(b), 1996 Act.

innovative network designs by CLECs and IXCs. MCI offers the following comments in the hope that the Commission will make this issue the focus of its technology testing rules.

II. Additional Regulatory Relaxation is only Required with Respect to CLEC and IXC Tests that Seek to Combine ILEC Network Features with their Networks

A. The Commission has sufficiently relaxed regulation for new technology and market testing for ILECs

The Commission solicited comment on the effect of the substantial efforts to reduce regulatory burdens it has already accomplished in recent years and, whether any additional actions are desirable to promote technology testing.[4] The Commission rightly noted that it has already taken substantial efforts to relax regulation and promote new services offered by ILECs. Recent technology and service deployment incentives taken by the Commission include:

- implementing Section 402(b)(1)(A)(iii) of the 1996 Act which provides for streamlined tariff filings by local exchange carriers (LECs);[5]

- concluding any tariff hearings within five months after the date, the charge, classification, regulation, or practice subject to the hearing becomes effective;[6]

- determining that the "deemed lawful" language of Section 402(b)(1)(A)(iii) of the 1996 Act precludes the Commission from awarding damages for the period that a streamlined tariff is in effect prior to a determination that the tariff is unlawful;[7]

- relying on post-effective tariff review, rather than reviewing ILEC tariff filings before they become effective, permitting LEC tariff revisions to become effective more quickly on a routine basis;[8]

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[4] *Ibid.*

[5] *See*, Implementation of Section 402(b)(1)(A) of the Telecommunications Act of 1996, Notice of Proposed Rulemaking, CC Docket No. 96-187, released September 6, 1996.

[6] 47 U.S.C. § 204(a)(2)(A).

[7] Implementation of Section 402(b)(1)(A) of the Telecommunications Act of 1996, Notice of Proposed Rulemaking, CC Docket No. 96-187, released September 6, 1996.

[8] *Id.*

- requiring that petitions against LEC tariff filings that are effective within 7 or 15 days of filing to be filed within 3 days after the date of the tariff filing and replies 2 days after service of the petition; [9]

- establishing a program for the electronic filing of tariffs that permit carriers to file tariffs by means of dial-up "on line" access;[10]

- permitting LECs and the National Exchange Carrier Association (NECA) to submit revisions to their annual access tariffs on 90 days' notice;[11]

- proposing to raise the size threshold required for Class A accounting thus allowing mid-sized carriers currently required to use Class A accounts to use the more streamlined Class B accounts;[12]

- proposing to establish less burdensome cost allocation manual ("CAM") procedures for the mid-sized incumbent local exchange carriers ("LECs");[13]

- proposing to reduce the frequency with which independent audits of the cost allocations based upon the CAMs are required;[14]

- reducing Uniform System of Accounts ("USOA") to reduce accounting requirements and to eliminate or consolidate accounts;[15]

- exempting price cap local exchange carriers (LECs), average schedule LECs, and all local non-dominant carriers from the section 214 requirements for new or extended domestic lines;

- granting blanket authority for dominant, rate-of-return carriers to undertake small technology projects;

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[9]*Id.*

[10]*Id.*

[11]*Id.*

[12]1998 Biennial Regulatory Review of Accounting and Cost Allocation Requirements, CC Docket No. 98-81; United States Telephone Association, Petition for Rulemaking ASD File No. 98-64, released June 17, 1998, at 3.

[13]*Ibid.*

[14]*Ibid.*

[15]*Ibid.*

- requiring only dominant, rate-of-return carriers that propose large infrastructure projects to obtain Section 214 certification for new or extended lines;
- permitting these dominant, rate-of-return carriers to file streamlined applications subject to automatic approval after thirty-one days; and
- eliminating the requirement that BOCs file Comparably Efficient Interconnection (CEI) plans and obtain Common Carrier Bureau (Bureau) approval for those plans prior to providing new intraLATA information services. [16]

B. Further relaxation of rules governing ILEC technology testing is not needed

The development of the Advanced Intelligent Network (AIN) has altered the process of service and technology testing, at least for the ILECs. In the traditional telephone network, call routing and other service logic were contained in the local switch. This meant that if the ILEC wanted to introduce a new service, it either had to wait for the manufacturers to develop the required software or coax them to develop this software, and then test the software and the new services that might be offered using these new capabilities. The process of technology testing required significant up-front costs that might justify relaxing regulations associated with testing new technologies and services.

In the AIN, databases and computer platforms called Service Control Points (SCPs) are added to the network and located at a point outside of central office switches. This allows the ILEC to develop new and customized services quickly, independent of the switching manufacturer. The result is more rapid technical and service development with much lower up-front costs.[17] With the advent of the AIN, ILECs are able to test new technologies and services

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[16] *Computer III* Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services, 1998 Biennial Regulatory Review CC Docket No. 95-20, and Review of *Computer III* and ONA Safeguards and Requirements Further Notice of Proposed Rulemaking, CC Docket No. 98-10, released: January 30, 1998.

[17] For a discussion of the AIN and the importance of developing nondiscriminatory access to AIN triggers to CLECs and IXCs, *See*, Attachment 1: Affidavit of Dale N. Hatfield, Exhibit H, Application of Ameritech Michigan Pursuant to Section 271 of the Telecommunications Act of

much more quickly and economically than in the recent past. In short, the economic rationale for further relaxation of regulations in order to promote ILEC technology and service testing is weak at best. The numerous steps the Commission has recently taken to promote new ILEC services and technologies enumerated above, combined with the reduced economic justification for incentives to ILECs to engage in technology and service tests, justify having the Commission focus its inquiry in this NOI on improving CLEC and IXC testing of new technologies and services.

C. Varied technical innovation and service development is dependent on CLECs and IXCs gaining timely access to ILEC network features that are not yet tariffed or made generally available.

CLECs and IXCs desperately require the ability to utilize features of ILEC networks that may not be tariffed, either as services or as unbundled network elements. Recent developments in the deployment of common channel signaling systems, AIN, and multimedia applications are increasing the technical complexity associated with CLEC and IXC interconnection with ILEC networks.

The increased complexity of the interface between ILEC networks and those of CLECs and IXCs, is a direct result of the development of the SS7/AIN architecture. AIN permits a local switch to recognize signals that can be sent while a call is in progress. This sort of trigger permits a user to take some action while the conversation is proceeding; perhaps to swipe a credit card reader or replenish a debit card, rather than simply terminate the call. The ability to access these trigger points in the AIN network will play a large role in the ability of IXCs and CLECs to differentiate their services from those of the ILECs. If competitors gain timely access to these trigger points, they will rapidly increase the variety of service and pricing options available to

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1996 to Provide In-region, InterLATA Services in Michigan, CC Docket 97-137, June 5, 1997.

consumers. As stated in a recent National Reliability Council report:

> Access to AIN triggers implies that the local service provider's switch is equipped with the appropriate trigger detection software and that the local service provider allows the third-party service provider the use of these triggers for call control in support of features and services. The availability of triggers for third-party access in a multi-provider environment is another key AIN issue that the industry must address. Without access to local switch triggers, a third party service provider's ability to offer its own AIN services is limited.[18]

There are a variety of ways ILECs may use technical issues as cover, either to delay competitors' timely access to network intelligence; degrade the quality of competitive access to network intelligence; or impose unnecessary costs on competitors to access that intelligence. ILECs may refuse to provide access to certain AIN triggers on the grounds that such access may result in technical harm to their network. They may agree to offer interconnection only if signaling messages pass through a filter, which can limit or degrade the performance of a competitor's service. They may also refuse to permit a CLEC to interconnect at an SCP, and thereby force the competitor to place sensitive customer information in the ILEC's data base at the SCP.

D. Standards fora have failed to implement technical solutions to interconnection disputes in a timely fashion.

Timely development of industry standards must be completed in order for the increasing complexity associated with interconnection in a multi-provider environment to result in greater choice for consumers. The Commission attempted to use its ONA rules to standardize interconnection with advanced features of ILEC networks. After several years of proceedings, that began in 1985, those rules failed to make the basic building blocs of the local telephone

[18]Network Reliability Council (NRC) Reliability Issues - Changing Technologies Focus Group, Advanced Intelligent Network, Subteam Final Report, Section 5.9.1. See attached Hatfield Affidavit at 19.

network available, and no longer receive support from the competitive service providers they were intended to serve.

The Commission subsequently referred the issue of standardized access to AIN trigger points in a multi-provider environment to the Information Industry Liaison Committee (IILC). After many years of deliberation, the group reached consensus in April 1995 regarding the opening of 13 AIN trigger points. However, today, a decade after the Commission first recognized the need for standardized access to network intelligence points, competitive providers still do not have access to these points.[19] This issue has now been referred to the Network Industry Interoperability Forum (NIIF).

The NIIF is ostensibly an industry-wide body. However, the agenda and technical solutions considered by the NIIF are effectively controlled by a private industry forum established by the ILECs — the AIN forum. The NIIF is currently considering ways to implement access to AIN trigger points, but is focused on technical solutions offered by the private, AIN forum. These solutions are not necessarily the most efficient for MCI's network design, or the network designs of other CLECs and IXCs. MCI has made proposals for more efficient routing of triggers between our network and ILEC networks to the NIIF, but the NIIF has not included this or other non-ILEC proposals for consideration.[20]

The attempts of the ILECs to implement essentially proprietary standards, and avoid general industry-based solutions are not new. In late 1980s, Bellcore pushed its proprietary

[19] See Attachment 3, Affidavit submitted by Peter Guggina in Computer III Further Remand Proceedings, CC Docket No. 95-20, March 1998.

[20] See Attachments 2 and 3, affidavits submitted by Peter Guggina in Computer III Further Remand Proceedings, CC Docket No. 95-20, April 1995, and March 1998, for a discussion of how the ILECs have frustrated the development of timely solutions to AIN interconnection points.

version of SS7 Transaction Capability Application Part (TCAP) through the T1 standards process, in spite of the objections from AT&T and other IXCs. Bellcore version of TCAP is incompatible with the international (ITU) version, but provides flexibility for the ILECs to support their proprietary services, such as Line Information DataBase (LIDB), Advanced Intelligent Network (AIN), without going through the rigor and scrutiny of T1 and ITU standards process.

This incompatibility between the T1 and ITU TCAP has forced IXCs and international carriers, such as MCI, to support both versions of TCAP in order to interconnect with the ILECs and international PTTs, thereby increasing the cost of providing services. TCAP incompatibility is also one of the factors why the international/global intelligent network (IN) standards and interconnections have been delayed because the resulting international (ITU) IN is incompatible with Bellcore's AIN.

E. Standards fora would benefit from a full range of technical solutions to interconnection issues

In this docket, the Commission has an opportunity to democratize AIN and other interconnection standards, that would receive widespread industry support. This would be accomplished in two ways. First, permit CLECs and IXCs to gain access to ILEC network facilities before they have been tariffed and made available as services. This would give competitors the opportunity to test the feasibility and efficiency of different interconnection arrangements between their networks and those of the ILECs. The information gained from these technology trials would ensure a more representative array of technical solutions would be presented either to industry fora or to the Commission for resolution.

Second, require ILECs that apply for market or technology trials to give advance notice of these trials. Competitors would then have the option of performing parallel, but independent technology trials, or piggy-backing on ILEC trials. Currently, ILECs are only required to provide notice of changes that will be implemented throughout their networks.[21] Even with 6 months advance notice, there is not sufficient time for standards bodies to develop solutions that might ameliorate the impact of these changes on CLEC and ILEC networks. Standards bodies have not completed the work on AIN trigger points after a decade of deliberations.

Permitting CLECs and IXCs to perform simultaneous, separate technology tests, or piggy back on ILEC tests, would give competitors the opportunity to test the feasibility and efficiency of different interconnection arrangements between their networks and those of the ILECs. The information gained from these technology trials would ensure a more representative array of technical solutions would be presented either to industry fora or to the Commission for resolution.

III. Conclusion

The Commission has taken numerous recent steps to promote technology and market testing by ILECs. The development of AIN has made it easier and less risky for ILECs to perform technology testing. Additional technology and marketing incentives for ILECs are not needed. In contrast, CLECs and IXCs are currently unable to test technical solutions that interconnect their networks with ILEC networks on a limited trial basis. For these reasons, MCI encourages the Commission to adopt the proposals and recommendations made by MCI in these Comments.

Respectfully submitted,
MCI TELECOMMUNICATIONS CORPORATION

Lawrence Fenster

July 21, 1998

Lawrence Fenster

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[21] See, e.g., 47 C.F.R. §64.702(d)(2) and 47 C.F.R. §68.110(b).

ATTACHMENT 1

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In the Matter of	)	
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Application of Ameritech Michigan Pursuant to Section 271 of the Telecommunications Act of 1996 to Provide In-Region, InterLATA Services in Michigan	)	CC Docket No. 97-137

Exhibit H:
Affidavit of Dale N. Hatfield
on Behalf of MCI Telecommunications Corporation

BEFORE THE
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In the Matter of	)	
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Application of Ameritech Michigan	)	CC Docket No. 97-137
Pursuant to Section 271 of the	)	
Telecommunications Act of 1996 to	)	
Provide In-Region, InterLATA Services	)	
in Michigan	)	

AFFIDAVIT OF DALE N. HATFIELD

I. Introduction

MCI Telecommunications Corporation has asked me to analyze certain issues raised by Ameritech's application, under Section 271 of the Telecommunications Act of 1996 ('96 Telecommunications Act), for authorization to provide in-region, interLATA services originating in Michigan. More specifically, they have asked me to (a) offer an opinion on the short-to-medium term prospects for competition in the provision of local exchange facilities and services, (b) describe certain technological changes that are occurring in local exchange networks, and (c) evaluate the power and ability of Ameritech to engage in anticompetitive, discriminatory activities given those prospects and technological changes.

Before presenting my summary and conclusions, I will briefly set forth my relevant experience in the telecommunications field. I am a telecommunications consultant and founder and Chief Executive Officer of Hatfield Associates, Inc., a telecommunications consulting firm. I received a Bachelor of Science degree in Electrical Engineering from Case Institute of Technology in 1960 and a Master of Science degree in Industrial Management from Purdue University in 1961. From 1963 until 1971, I was employed as a communications engineer with the Institute for Telecommunication Sciences of the U.S. Department of Commerce. Between

1971 and 1974, I held various communications policy analyst positions with the Office of Telecommunications in the Department of Commerce. In 1974, I was appointed Deputy Chief of the Office of Studies and Analysis, Office of Telecommunications Policy, Executive Office of the President. In 1975, I moved to the Federal Communications Commission, where I became Chief of the Office of Plans and Policy. In 1977, I returned to the Department of Commerce, where I became Associate Administrator for Policy Analysis and Development, National Telecommunications and Information Administration. In 1981, I was appointed Deputy Assistant Secretary of Commerce for Communications and Information and Deputy Administrator of the National Telecommunications and Information Administration.

In 1982, I left government and established my own consulting firm. For the past fourteen years, our firm has specialized in engineering, economic, and policy studies in the telecommunications field. I was the founding Director of the Telecommunications Division of the University College at the University of Denver, and I am an adjunct professor in the Graduate Program in Telecommunications at the University of Colorado at Boulder. I was also a Senior Fellow of Northwestern University's Annenberg Washington Program in Communications Policy Studies until its closing last year. For over a decade, I have taught a regular series of seminars on telecommunications technology for policymakers and regulators in Washington, D.C. I have taught similar courses for the Federal Communications Bar Association, for the National Association of Regulatory Utility Commissioners, and for other public and private entities. For the past four years, I have been teaching a series of seminars on telecommunications policy and regulation in Central and Eastern Europe. As a consultant and expert witness, I have testified before the state public utility commissions in Arizona, California, Colorado, Connecticut, Idaho, Missouri, Nevada, New Mexico, Ohio, and Washington, as well as before the Federal Communications Commission and the Canadian Radio-television and Telecommunications Commission. I have also testified in federal court and before the Congress on antitrust and other matters.

From these activities in the public, private, and academic spheres, I am familiar with (a) the technical and economic aspects of the organization and operation of telecommunications networks in the United States and (b) the issues raised by Ameritech's application, under Section 271 of the '96 Telecommunications Act, for authorization to provide interLATA services originating in Michigan.

Summary and Conclusions

I have been asked to analyze certain issues raised by Ameritech's application for authorization to provide in-region, interLATA services in Michigan. Based upon that analysis, which is described in detail herein, I have reached three fundamental conclusions:

First, the incumbent local exchange carriers, including Ameritech, will retain bottleneck control over the local exchange network for the foreseeable future. Hence, they will continue to have the power to discriminate against not only unaffiliated long-distance carriers but emerging, competitive local exchange carriers as well.

Second, technical developments in local exchange networks in terms of (a) the deployment of advanced signaling systems, (b) the related development of intelligent network architectures or software driven network elements, and (c) further developments in multimedia applications are resulting in the need for different and generally more complex forms of network interconnection. Because of the increased complexity of the required forms of interconnection, incumbent local exchange carriers, including Ameritech, have an increased ability to discriminate and to raise unfounded claims of technical harm and technical infeasibility in the provision of advanced forms of interconnection to long-distance (and local) carriers.

Third, because of the first two conclusions, the incumbent local exchange carriers, including Ameritech, have the power to thwart or delay the development of advanced competitive long-distance services that are increasingly critical to interexchange carriers in differentiating their services in an intensely competitive market. These advanced forms of interconnection go far beyond the basic forms of interconnection required to achieve equal access following divestiture. Therefore, past experience with the interconnection of traditional voice and data networks will be less useful as a regulatory tool for preventing, detecting, and remedying discrimination in the future.

II. Prospects for Local Exchange Competition

Over the past twenty-five years or so, competition has been successfully introduced into the customer premises equipment and long-distance portions of the telecommunications market. I attribute this success to three principal factors: (1) the striking down of legal prohibitions on competition in these two segments of the telecommunications market, (2) the lack of significant economies of scale or natural monopoly characteristics in either of the two segments, and (3) the divestiture of the Bell Operating Companies (BOCs) from AT&T and the accompanying line-of-business restrictions that reduced the incentives of the divested BOCs to use their market power to discriminate against participants in the two competitive segments.

A combination of factors has held back competition in the local telephone segment of the telecommunications market, including: (1) legal barriers to entry at the state level, (2) the massive size of the initial investments required to duplicate the existing local exchange network infrastructure, (3) difficulties in gaining the necessary interconnection arrangements with the incumbent local exchange carriers and in obtaining needed rights-of-way, (4) unnecessary bundling and resale restrictions imposed by the incumbent local carriers, and (5), more generally, difficulties in overcoming the natural monopoly characteristics of local telecommunications networks. Thus, despite local telephone company predictions to the contrary, the degree of local competition has remained *de minimus*.

In passing the Telecommunications Act of 1996, Congress took critical steps to facilitate the development of competition in the provision of local telecommunications facilities and services. It did so by affirming the policy of relying upon competition in telecommunications generally and, more specifically, by legislating against statutory and regulatory barriers to entry, by establishing the legislative groundwork for economical and non-discriminatory interconnection arrangements, and, among other things, by prohibiting unnecessary and unfair bundling and resale restrictions. Recently, in CC Docket No. 96-98, the Federal Communications Commission (FCC) took important first steps to achieve the pro-competitive goals of the 1996 Act.[1] Despite these critical steps by the Congress and the FCC, I continue to have strong reservations about whether robust competition in the provision of local telecommunications services will actually develop.

My reservations stem from two factors. First, I am concerned that, unlike the situation in the long-distance and equipment manufacturing sectors of the market following divestiture, the BOCs, including Ameritech, have a strong incentive to impede competition in their core market --

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[1] Local exchange carriers and some states have successfully petitioned the courts for a stay of critical portions of the FCC's order in CC Docket No. 96-98. This has created additional regulatory uncertainty for potential entrants in the local exchange market.

the provision of local exchange and exchange access services. Indeed, given the trivial amount of local competition that exists today, they not only have the incentive, but they also have the power to impede competition. Second, while striking down statutory and regulatory restrictions and eliminating or reducing other barriers to entry are *necessary*, they may not be *sufficient* to ensure the development of robust local competition. They may not be sufficient because of the enormous cost of creating multiple local telecommunications networks and the high risks associated with gaining sufficient market penetration to achieve reasonable economies of scale.

Over the past several years, our consulting firm, Hatfield Associates, Inc. (HAI), has undertaken extensive studies that address the economic feasibility of local competition developing from three alternative sources: cable television, wireless local loop, and competitive access providers.[2] The original study, entitled the *Enduring Local Bottleneck* (ELB-I), was completed before the passage of the '96 Telecommunications Act. In January 1996, HAI provided a qualitative assessment of the technological and marketplace changes since the publication of the original. More recently, in a report entitled the *Enduring Local Bottleneck II* (ELB-II), we updated the cable telephone and wireless local loop quantitative analysis contained in the original report.[3] As with ELB-I, the economic modeling suggests that firms using alternative technologies can compete with incumbent local exchange carriers such as Ameritech. The updated analysis continues to show, however, that -- even under best case scenarios -- such entry by cable and wireless companies is not very profitable and, because of the large investments required, there is a

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[2] Economics and Technology, Inc./Hatfield Associates, Inc., The Enduring Local Bottleneck: Monopoly Power and the Local Exchange Carriers, 1994.

[3] Hatfield Associates, Inc., The Enduring Local Bottleneck II, April 30, 1997.

long delay before positive cash flow is achieved. Under these conditions, investors will be reluctant to commit large amounts of capital and, indeed, the capital resources necessary for widespread deployment of these alternative technologies may not appear.

Our analysis goes a long way in explaining, on a quantitative basis, why (1) the cable industry has apparently pulled back from full-scale telephony deployment and is focused more on providing Internet access services and on expanding and protecting their core business of delivering entertainment video programming, (2) the emerging wireless Personal Communications Service providers appear to be focused almost entirely upon competing with existing cellular mobile radio carriers rather than providing ordinary local telephone services, and (3) the competitive access providers (CAPs) still seem focused primarily on providing switched and dedicated transport services to business customers in limited -- typically downtown -- areas.[4] While the latter group, the CAPs, are leasing local loop and other unbundled facilities from the incumbent local exchange carriers (ILECs) in order to extend their geographic coverage, the amount of full facilities-based competition they provide is limited. In general, it is important not to confuse glowing press releases on limited market tests and premature technology "hype" with firm commitments and enduring actions by organizations with the substantial financial and technical resources to actually construct alternative networks on a ubiquitous and timely basis.

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[4] AT&T recently announced a new wireless local loop technology that may turn out to be more promising than earlier developments. However, little technical or cost information on the technology has been released and hence there is no reliable way of forecasting whether and, if so, when the technology might be deployed on a widespread basis.

III. Technological Changes in the Local Exchange Network

The BOCs (including Ameritech) currently have strong strategic control over how customers reach independent networks and how providers of independent networks reach their customers. As long as the BOCs have monopoly power in the local exchange market, they have the power to technically discriminate in favor of their own competitive long-distance operations. They also have the power to refuse to offer (or to delay the provision of) technically feasible forms of interconnection and unbundled network elements to competitors wishing to offer differentiated services. Moreover, certain developments in local exchange networks have increased the risk of technical discrimination since divestiture. The three most significant developments in this regard are (1) the further deployment of common channel signaling systems, (2) the development of "intelligent" or software driven networks, and (3) further developments in multimedia applications (i.e., applications that involve combinations of voice, data, image, and video traffic). These developments are described in the paragraphs which follow.

A. The Deployment of Common Channel Signaling Systems

Besides conveying the customer's actual telephone message or conversation, a telephone network must also convey other information associated with setting up, disconnecting, and otherwise controlling the call itself. The transmission and reception of such control information between the customers and the network or between elements (e.g., switches) within the network is called signaling. Signaling is necessary for the establishment and control of connections through the network or collection of networks. An example of signaling information would be the address of the called party or an indication that the called party has "gone off-hook" or answered the call. Such control information is needed, for example, to route the call and to properly bill for it.

Until fairly recently, signaling in the telephone network was carried within the same channel or path that carried the telephone conversation or message. This was done by sending audible (Multifrequency or "MF") tones and the technique, accordingly, was called "in-band" signaling. The more modern arrangement, which is now used extensively throughout both LEC and IXC networks, is called common channel signaling. With common channel signaling, signaling information is exchanged via a data network (actually a specialized packet-switched network) that is separate from the conversation path. In-band signaling has significant limitations compared to modern common channel switching signaling systems. Common channel signaling (CCS) and the Signaling System 7 (SS7) protocol overcomes these limitations and becomes a crucial component of not only ordinary calling, but also of current and future network-based services. Or, as summarized by a Director at Bellcore:

> CCS/SS7 not only provides faster call set-up but also can be used to support a variety of services. These services include CLASS℠, Calling Name Delivery and ISDN services. CCS and SS7 also support Advanced Intelligent Network (AIN) and Personal Communications Services (PCS).[5]

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[5] Merrell, Ann E., "CCS/SS7 - A Services Perspective," Annual Review of Communications (National Engineering Consortium, Chicago, IL, 1992), p. 599.

Current SS7-based offerings include Calling Card, 800-Number, and CLASS℠ services.[6] The latter include automatic callback, automatic recall, calling number/name identification, selective call acceptance/rejection, distinctive ringing, customer originated call time and several others.[7]

Another expert notes that:

> SS7 is really a *control* network, as well as a signaling network. This is important to understand, because as the Information Highway rolls out, and as the Advanced Intelligent Network (AIN) is implemented, SS7 will be relied upon almost exclusively as a means for telephone companies and other service providers to share database information and switching control without human intervention.[8]

Thus, while the deployment of this advanced common channel signaling system is important in its own right because of increased efficiencies in setting up, disconnecting, and otherwise controlling telephone calls, it is also critical to the development and deployment of AIN. As the author quoted immediately above notes, "Without SS7, AIN is not possible."[9]

SS7's expanded vocabulary, its ability to exchange signaling information independent of a call, its ability to exchange signaling information during the call, its increased speed, and its other advanced characteristics all lead to the conclusion that the interconnection of SS7-based networks is more complex than the interconnection of networks using traditional in-band signaling

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6 CLASS was originally an acronym for the term Custom Local Area Signaling Services. It is now used as a servicemark for a collection of telephone company-provided services.

7 Bellcore, BOC Notes on the LEC Networks, Special Report SR TSV-002275, Issue 2, April, 1994, pp. 14-13 thru 14-19.

8 Russell, Travis, Signaling System #7, McGraw-Hill Series of Computer Communications, McGraw-Hill, New York, 1995, p. xvi.

9 Id.

techniques. This complexity is heightened by the expanded role that SS7 plays as a control network and central nervous system of the modern telephone network.[10]

B. Advanced Intelligent Network[11]

In the traditional telephone network, all of the instructions or service logic on how to process or route a call were contained within the local switching platform itself. This meant that, if the local exchange carrier wanted to introduce a new service, it had to wait for the manufacturers to develop the required software, and then it had to install the new software in each of its local (end office) switches. In the Advanced Intelligent Network concept, on the other hand, data bases and computer platforms called Service Control Points (SCPs) are added to the network and located at a central point outside of the existing central office switches. This allows the local exchange carrier to develop new and customized services more quickly, at lower cost, and independent of the provider of the local switching equipment. These local exchange switches, referred to as Service Switching Points (SSPs) in the AIN concept, are equipped to recognize certain triggering events such as when a subscriber dials a particular sequence of numbers, e.g., 1-800 or 1-888. When the trigger is activated, the switch (SSP) then sends a message containing

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[10] In the past, the BOCs and other incumbent LECs have been able to agree on the technical arrangements for interconnecting their networks. However, it took time and it ultimately succeeded because the interexchange carriers were primarily customers, not competitors, and, hence, the BOCs had no countervailing incentive to discriminate. That would change if the BOCs were authorized to compete in the interexchange business.

[11] The generic term for the developments described in this section is intelligent networks. In the United States, the most prevalent deployment scenario is provided by Bellcore's Advanced Intelligent Network -- AIN -- architecture.

information about the call over the SS7 network to the remote SCP asking for instructions on how it is to be routed.[12] The SCP then sends the routing instructions back to the SSP.

The SCP can be used to have the call routed differently depending upon the calling or called number, the geographic location of the called party, the time-of-day, additional information requested from and provided by the person placing the call (e.g., by the network furnishing voice prompts asking the user to enter additional digits such as a Personal Identification Number -- PIN), information provided by the called party, the status of the called line, or conditions in the network. For example, all calls to a single telephone number assigned to a particular pizza restaurant chain can be routed to the nearest outlet of the chain. This can be accomplished by logic residing in the SCP utilizing the telephone number of the caller (i.e., the calling number) and information on restaurant locations stored in a data base accessible by the SCP.

Note that the Intelligent Network concept means that, in essence, the local exchange network is becoming increasingly programmable or software driven. As I suggested above, this allows the carrier to develop new and customized services more quickly and efficiently. Indeed, the AIN vision has been characterized as representing "a true software-only architecture in the public network, separating call transport from control"[13] and ". . . clearly the future of the public

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[12] The logic and information necessary to route a call when a trigger is encountered does not have to reside at a remote location. It may be contained in a computer that is attached to the local switch or SSP. This device is called an Intelligent Peripheral or adjunct. Separating the service logic from the switch in this manner has significant advantages. Conceptually, the AIN architecture allows the "intelligence" to be distributed throughout the network in an optimal way -- locally (e.g., in the IP or adjunct) as well as regionally or nationally (in an SCP).

[13] Fried, Jeff, "Extending CTI's Reach," Telephony (October 21, 1996), p. 46.

network."[14] Viewed in this way, the service logic is analogous to the application software residing in a computer (e.g., a word processing or spreadsheet program) and the basic call processing functionality is roughly analogous to an operating system (e.g., UNIX or DOS). Clearly, the interconnection of networks in the Advanced Intelligent Network environment, with the added interfaces, access to Service Logic and data bases at remote locations, and software-based programmability, is more complex than the interconnection of traditional telephone networks.

C. Multimedia Services

With the further deployment of digital transport facilities, advanced forms of switching such as Asynchronous Transfer Mode (ATM),[15] multimedia information sources (servers), and multimedia-capable terminal equipment (clients), the service offerings of carriers will increasingly involve the intermixture of voice, data, image, and video traffic in a single call or computer session. Clearly the interconnection of two networks carrying interactive, multimedia traffic is much more complex than past interconnection arrangements involving just voice or data separately. For example, in an ordinary circuit switched voice call, a fixed amount of capacity or bandwidth is allocated by each interconnected network for the duration of the call. Assuring adequate capacity in this environment revolves around ensuring that there are an adequate number of fixed capacity circuits to handle the offered traffic during the busy hour. On the other hand,

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[14] Glowacz, Dave, "AIN Services Get New Life in 1993," Telephony (January 11, 1993), p. 32.

[15] ATM handles a mixture of traffic types (e.g., bursty or constant and delay sensitive or non-delay sensitive) by converting all of the information into a common format consisting of a sequence of fixed length cells. In other words, all of the traffic, regardless of type, is "chopped up" into short cells that are individually processed (switched).